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General

Manual Scope

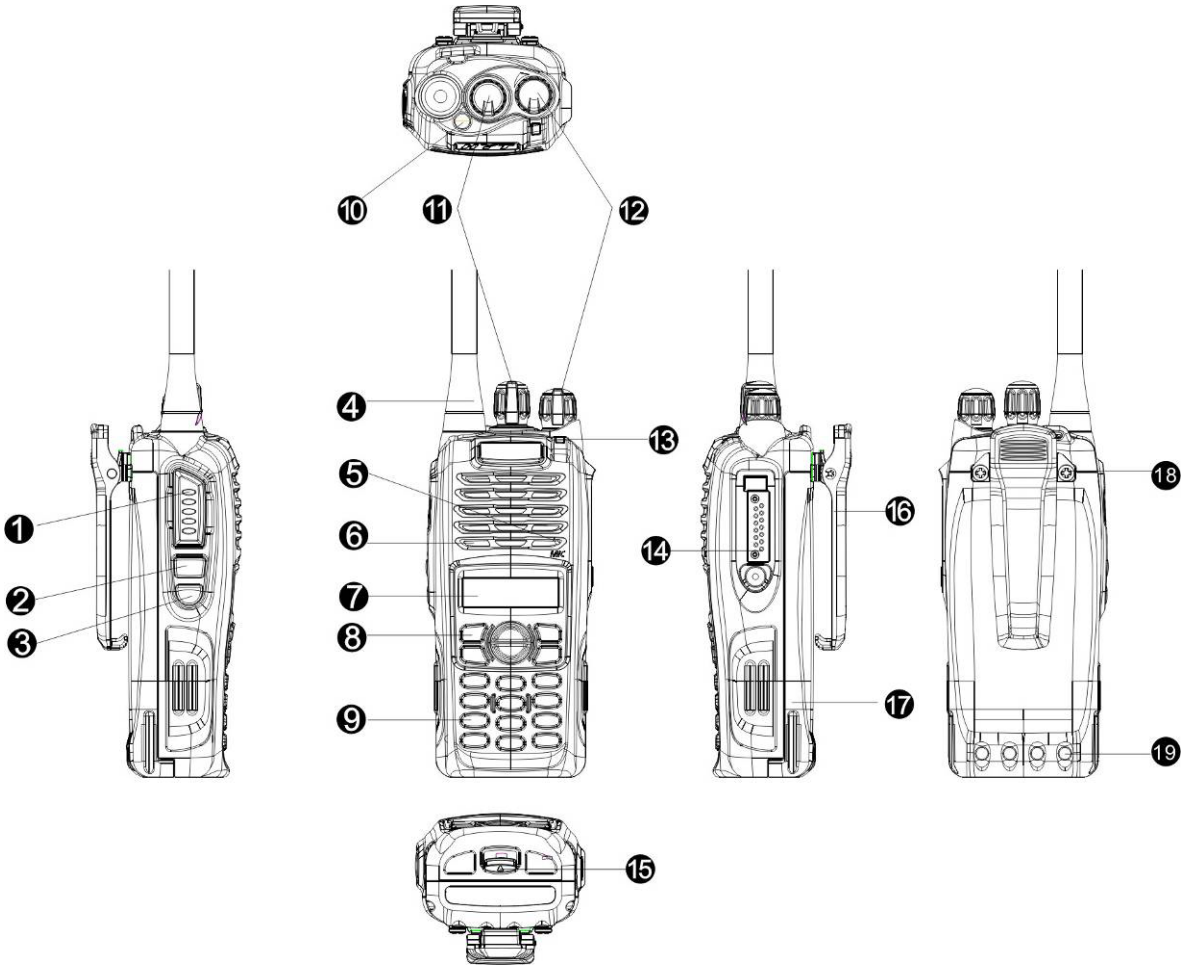
This manual is intended for use by experienced technicians familiar with similar types of communication equipment. It contains all service information required for the equipment and is current as of the publication date.

Safety and General Information

The following general safety precautions as would normally apply, should be observed during all phases of operation, service and repair of this equipment.

- This equipment should be serviced by qualified technicians only.
- Use only HYT supplied or approved antenna.
- Turn off your radio prior to entering any area with a potentially explosive atmosphere.
- To avoid electromagnetic interference and/or compatibility conflicts, turn off your radio in any facility where posted notices instruct you to do so.
- When instructed to do so, turn off your radio when on board an aircraft. Any use of a radio must be in accordance with airline regulations or crew instructions.
- To avoid possible interference with blasting operations, turn off your radio when you are near electrical blasting caps, in a blasting area, or in areas posted: “Turn off two-way radio.” Obey all signs and instructions.
- For vehicles with an air bag, do not place a radio in the area over an air bag or in the air bag deployment area.
- Do not use any portable radio that has a damaged antenna. If a damaged antenna comes into contact with your skin, a minor burn can result.
- Do not expose the radio to direct sunlight over a long time, nor place it close to heating source.
- If you wear a radio on your body when transmitting, ensure that the radio and its antenna are at least 2.5cm away from your body.

Radio Overview



① PTT (Push-to-Talk) Key	② SK1 (Side Key 1)	③ SK2 (Side Key 2)	④ Antenna
⑤ Microphone	⑥ Speaker	⑦ LCD Display	⑧ Function Keypad
⑨ Numeric Keypad	⑩ TK (Top Key)	⑪ Channel Selector Knob	⑫ Radio On-Off /Volume Control Knob
⑬ LED Indicator	⑭ Accessory Jack	⑮ Battery Latch	⑯ Belt Clip
⑰ Battery	⑱ Screw, Belt Clip	⑲ Charging Piece	

*** PTT (Push-to-Talk) Key**

Press and hold down the **PTT** key to transmit; release it to receive.

*** SK1 (Side Key 1)**

Programmable function key.

*** SK2 (Side Key 2)**

Programmable function key.

*** LCD Display**

Used to display radio status information.

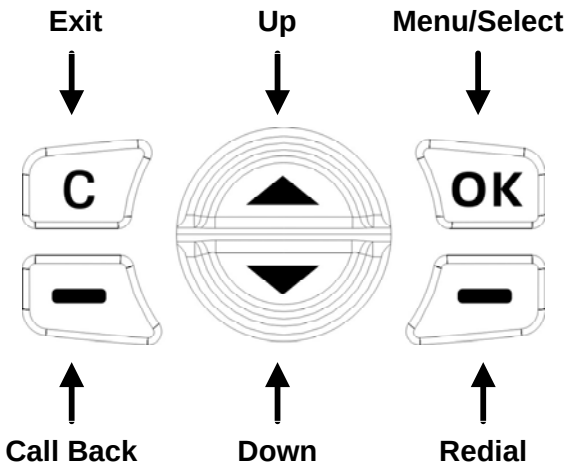
*** Function Keypad**

- **Exit key**

  Use the **Exit** key to return to the previous menu.

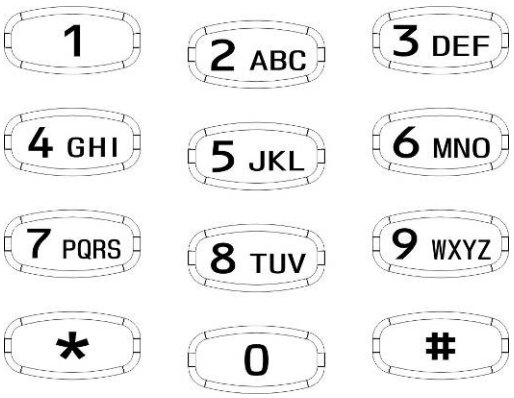
- **Up key**
- **Down key**
- **Menu/Select key**

  Used to enter the menu mode. When you are in the menu mode, this key is also used to make menu selections.



*** Numeric Keypad**

Used to enter information for programming the radio's lists.



*** TK (Top Key)**

Programmable function key.

＊ Channel Selector Knob

Rotate the knob to select a desired channel.

＊ Radio On-Off/Volume Control Knob

Rotate the knob clockwise to turn the radio on, and rotate the knob fully counter-clockwise until a click is heard to turn the radio off.

Turn the knob clockwise to increase the volume, or counter-clockwise to decrease the volume.

＊ LED Indicator

The following table indicates LED mode and corresponding radio status:

Status	LED
Transmit	Red
Receive	Green
Low battery alert	Flash red
After transmitting a call (within auto reset time)	Orange
After receiving a call (within auto reset time)	Flash orange slowly
Missed call alert	Flash orange rapidly
Scan	Flash green

＊ Accessory Jack

The jack is used to connect audio accessories, or other accessories such as programming cable.

Software Specifications

Specifications

- 256 Conventional Channels
- 32 Channel Groups
- 2-Tone/DTMF/HDC1200/HDC2400^{TM} Encode & Decode
- ATIS Encode
- Priority Channel Scan

When the radio operates in talkaround mode, the channel scan feature provides users with an easy way to monitor and join other channels.

a) Revert Channel

Press of the PTT during radio scanning shall cause the radio to transmit on the programmed revert channel.

b) Nuisance Channel Delete

To ensure accurate scanning, press the Nuisance Channel Delete key to temporarily remove the nuisance channel from the current scan list.

- Busy Channel Lockout

A channel already in use is not available to other users.

- Programmable Function Buttons

Six of the radio's buttons can be programmed as shortcut buttons for your most often used features.

- Time-out Timer

The feature allows for more efficient use of channels by limiting the amount of time of each transmission. The range is from 15 seconds to 600 seconds.

- Emergency

Press the Emergency key to emit emergency alarm, or send ENI (Emergency Number Identity) / background tone to a pre-defined person or the dispatch center, whichever is defined by the Emergency option. Press the button again to cancel the emergency procedure.

- VOX
- Dual Home Channels
- Optional Functions

    a) Man Down

b) External Scrambler

c) Patrol Record

d) GPS Function

Description

1. User Mode

This mode is for normal operation by end users.

2. All Reset Mode

Allows you to initialize tuning items, channel frequency, and conventional functions. See the Adjustment Description section for details.

3. Clone Mode

a) Factory Wired Clone Mode

b) Dealer Wired Clone Mode

c) Factory Wireless Clone Mode

d) Dealer Wireless Clone Mode

Press SK1 and to enter clone mode; press SK2 to toggle between wired and wireless clone modes; press TK to toggle between factory and dealer modes.

4. Manual Adjust Mode

Allows you to adjust frequency deviation, power level, sensitivity, squelch level, and etc.

Note: You must select Manual Adjust Mode from Optional Features in the programming software, before you can enter manual

5. PC Adjust Mode

Allows you to adjust the radio manually or automatically via PC.

Circuit Description

Circuit Composition

The overall circuit is composed of PLL-VCO circuit, transmit circuit, receive circuit, baseband processing

circuit, power supply circuit, and MCU control circuit.

Frequency Configuration

The receiver section utilizes double conversion. The first IF is 44.85MHz and the second IF is 455 KHz. The first local oscillator signal is supplied by PLL and VCO circuit. The second local oscillator signal is generated from TCXO (44.395MHz); The PLL and VCO circuit also generates the frequencies required by the transmit section.

1. Receive Circuit

Configuration of the receive circuit is shown in Figure 1.

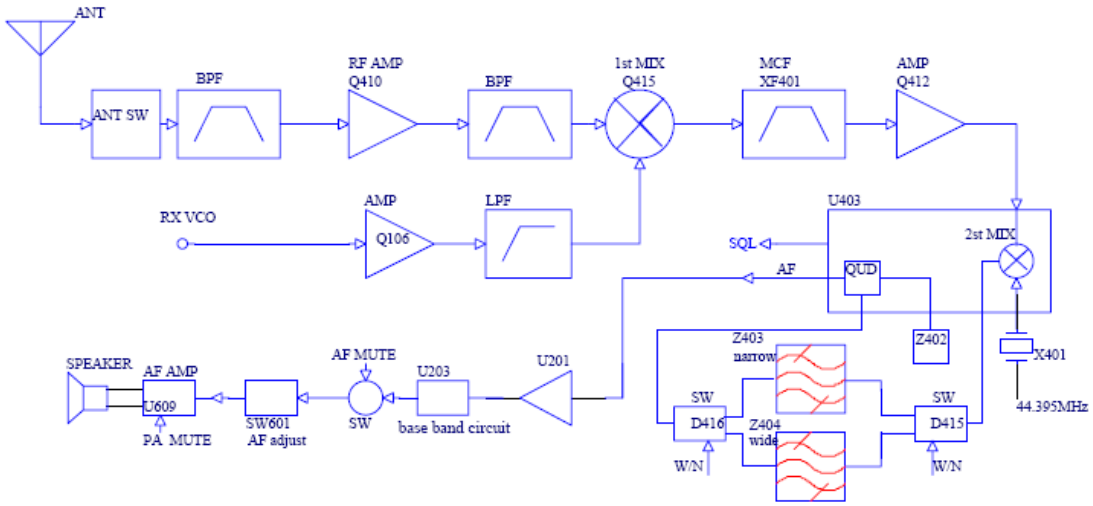


Figure 1 Receive Circuit

2. RF AMP BPF

The signal from antenna is amplified at RF amplifier (Q410) after passing through a transmit/receive switch circuit and a band pass filter. The amplified signal is filtered by a band pass filter to eliminate unwanted signals before it goes to the first mixer.

3. The First Mixer

The signal output by RF AMP BPF is mixed with the first local oscillator signal output by PLL frequency synthesizer at the first mixer (Q415) to create a 44.85 MHz first IF signal. The first IF signal is then fed through a crystal filter (XF401) to further remove spurious signals.

4. IF Amplifier

The first IF signal is amplified by Q412 and then enters U403 (TA31136FN). The signal is mixed with the

second local oscillator signal (44.395MHz) again to create a 455 KHz second IF signal, which passes through a ceramic filter (wide band: Z404; narrowband: Z403) to eliminate unwanted signals. The resulting signal is detected by U403 to output audio signal from Pin 9.

5. Audio Amplifier

The Rx audio signal output by U403 is amplified by U201, and then passes through the audio processor U203 (the received signalling is separated from the signal for decoding). The amplified signal then is fed to AF MUTE, volume switch SW601 (volume control) and Q615 (PA MUTE control). The resulting signal is finally fed to the audio amplifier U609 to output audio signal from speaker.

6. Squelch

Noise signal is derived from the Rx audio signal output by Pin 9 of U403, and is processed by U403 to produce an SQL level. The SQL level is then compared in CPU (U605) to generate a level which controls AF MUTE and PA MUTE. It controls Q204 and Q615 to enable or disable the audio path.

Transmit Circuit

The transmit circuit is composed of MIC circuit, frequency synthesizer, driver and final-stage power amplifier circuit, and the APC circuit.

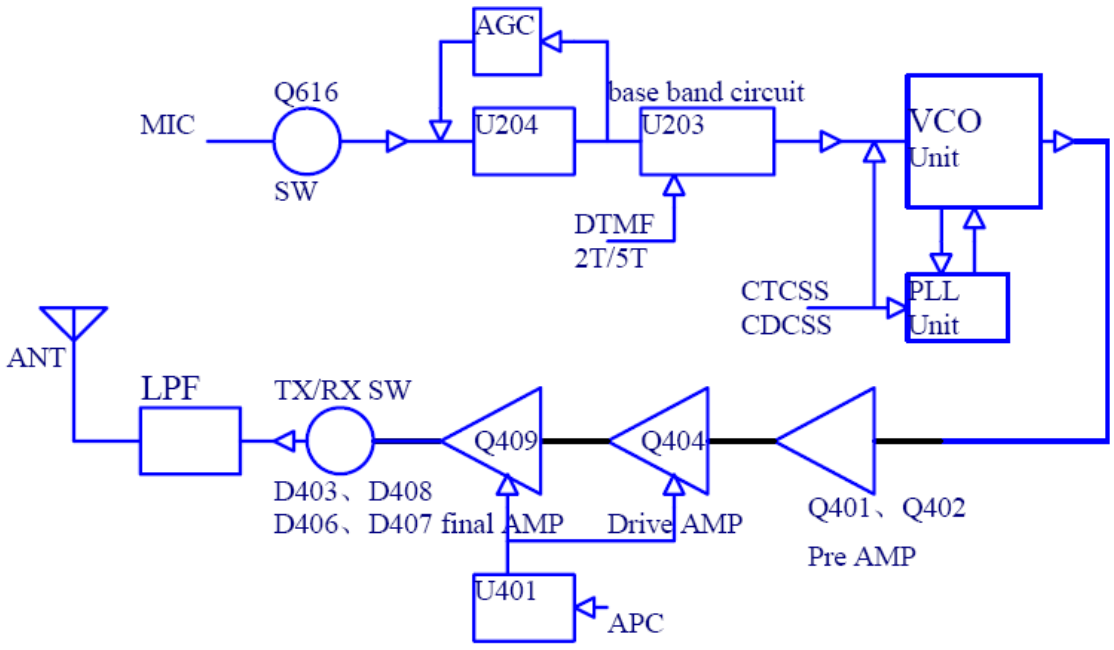


Figure 2 Transmit Circuit

1. MIC Circuit and Modulation Circuit

The audio signal from microphone is amplified by U204 after passing through the MIC control switch (Q616). The resulting signal is then amplified, pre-emphasized and etc by U203. Simultaneously, DTMF/2-Tone/5-Tone signallings generated by the MCU are amplified by U203, and then mixed with MIC audio signal, and finally fed to VCO for modulation.

2. Driver and Final-Stage Power Amplifier Circuit

RF signal from local oscillator circuit is amplified by Q401 and Q402. The amplified signal is fed to the driver stage Q404 and then the final-stage power amplifier (Q409) for amplification. The resulting signal then passes through LPF to filter harmonics before reaching the antenna for transmit.

3. APC

The automatic power control (APC) circuit stabilizes the transmit power by detecting the drain current of final-stage amplifier.

Frequency Synthesizer

PLL-VCO circuit generates frequency for receiving the first local oscillator signal and transmitting signals. PLL-VCO circuit consists of Tx frequency oscillator (Q103), Rx frequency oscillator (Q101), buffer amplifier (Q105), RF amplifier (Q107), PLL IC (U101), second harmonic circuit (Q108 and Q109) and Tx/Rx VCO control switch (Q111, Q112, Q110 and Q102).

In transmit mode, IC120 transmits the operating frequency data to PLL IC. PLL IC is turned on to activate Tx VCO. The outputted signal is amplified by Q703, Q124, and then divided by PLL IC (step: 2.5 KHz or 5 KHz, 6.25 KHz). The divided signal is compared with the reference signal from 16.8MHz crystal oscillator X101 (frequency stability: 2.5ppm) in the phase comparator. The frequency control voltage output from the phase comparator controls Tx VCO after passing through LPF. In the meantime, modulation signal (Tx) is passed to Tx VCO for frequency modulation.

The working principle in receive mode is similar to that in transmit mode.

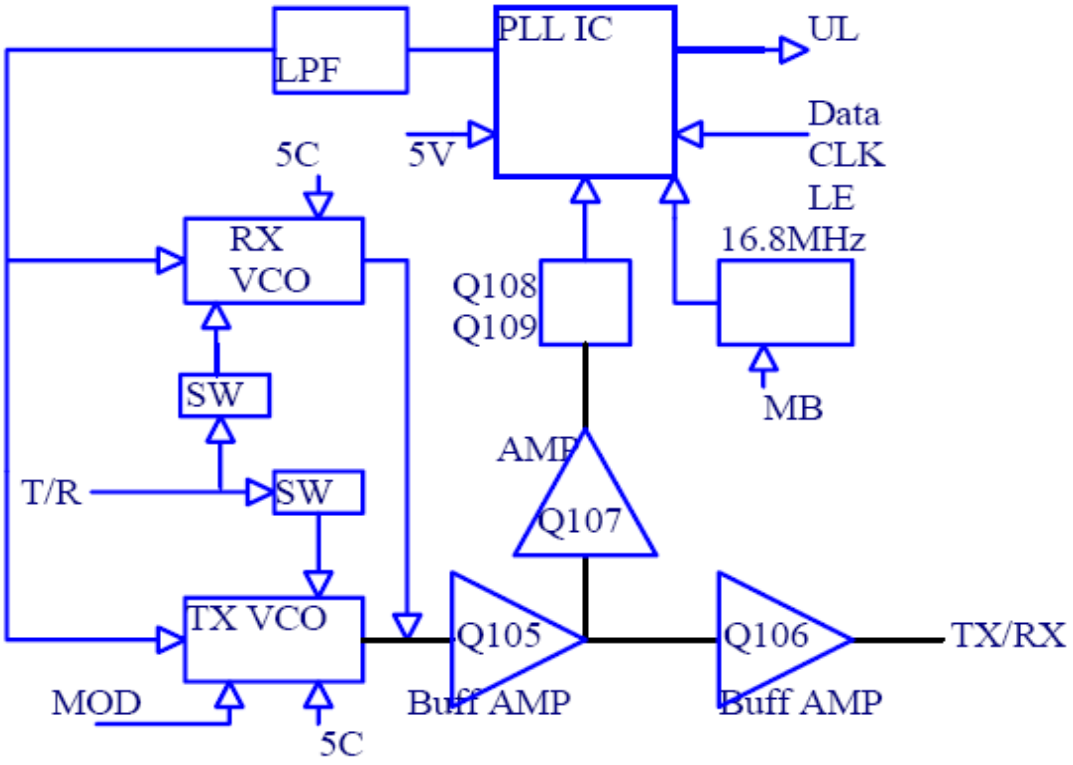


Figure 3 PLL Circuit

Control Circuit

The control circuit is comprised of MCU control circuit and power supply controller.

1. MCU

U605 (MCU) operates at 9.8304 MHz. The CPU controls data transmission among receive circuit, transmit circuit, control circuit, display circuit and peripheral circuit.

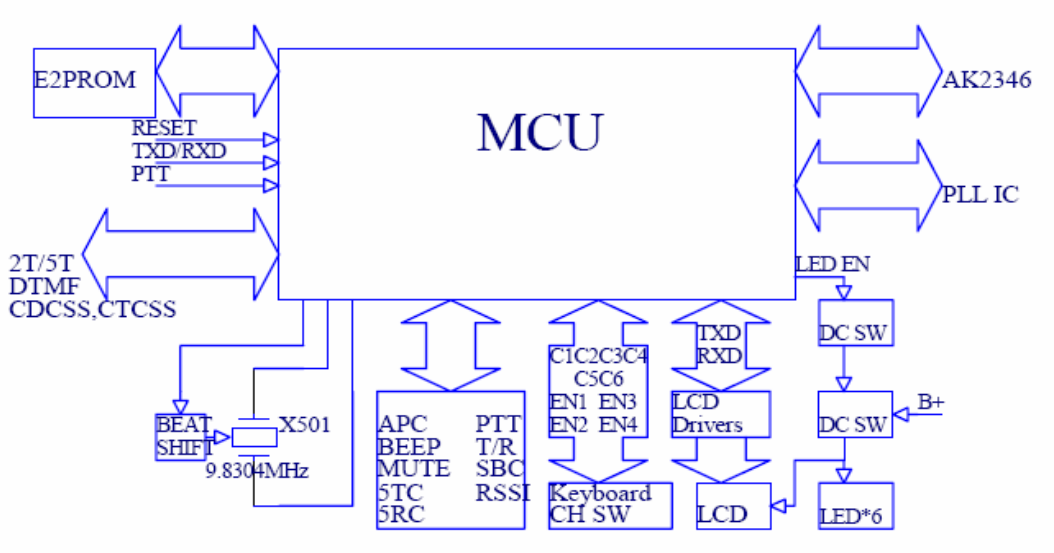


Figure 4 Control Circuit

2. Power Supply

Power supply of the radio is derived from the battery that supplies battery B+ after passing through fuse, and then passes through power switch. MCU controls power management IC (U602, U603, and U604) to generate voltage including C5V, 5CNS, R5V, T5V.

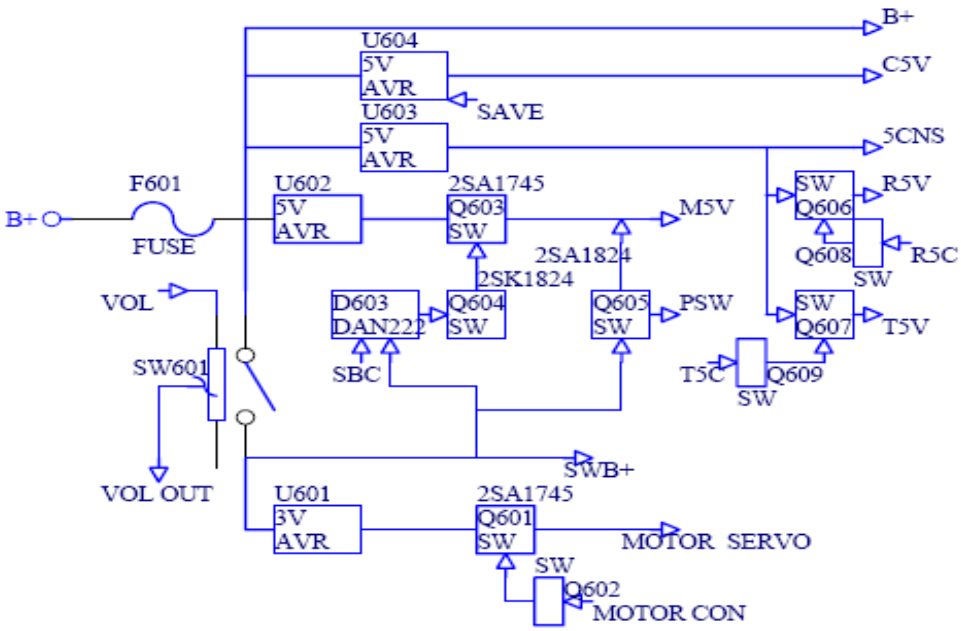


Figure 5 Power Switch Circuit

Keypad and Display Circuit

The display circuit is comprised of MCU (U605), LCD module, keyboard, LED and other components. The backlight enable pin LED_EN is controlled by MCU. When the pin LED_EN is H, the backlight shall be turned on.

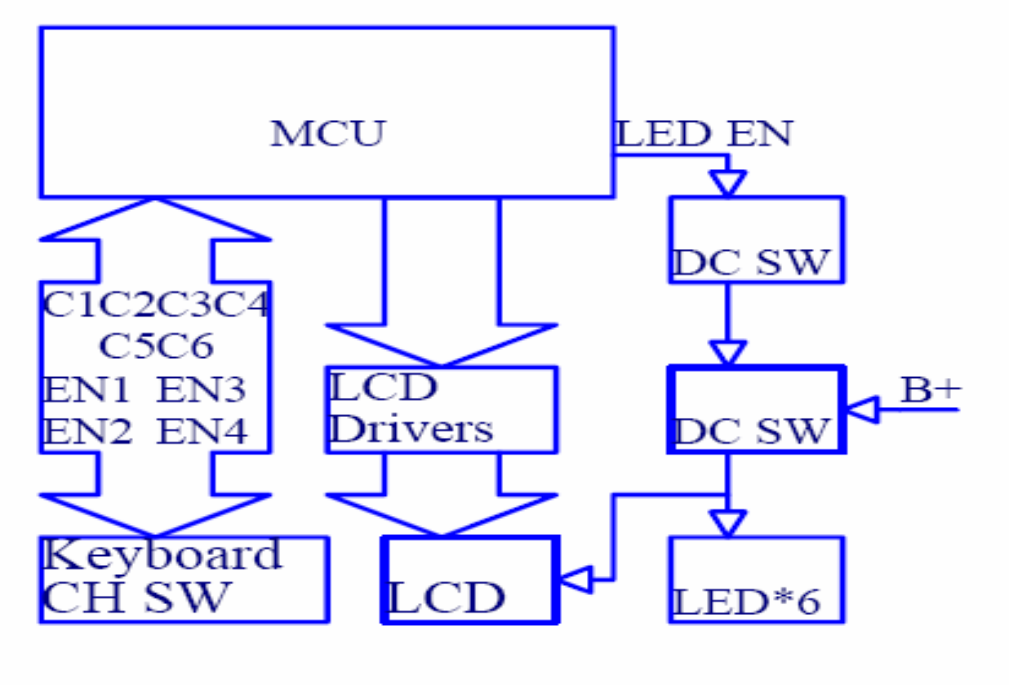


Figure 6 Display Circuit

CPU Pins

No.	Port Name	Pin Name	I/O	Function	Remarks
1	P94/DA1	APC/TV	O	Automatic power control/Rx bandpass control. Adjust APC and Rx bandpass through DA (0-5V).	
2	P93/DA0	TONEO	O	DTMF/2-Tone/5-Tone/Beep output /ALARM output (DA generates waveform). Cannot output from speaker.	
3	P92	LCM_SDI	O	LCM data, display module control data pin.	
4	P91	LCM_SCK	O	LCM clock, display module control clock pin.	
5	P90	TONE_IN	I	2-Tone/5-Tone input decode	
6	BYTE	BYTE	BYTE	Ground through resistor	
7	CNVSS	CNVSS	CNVSS	Pull down in operating mode, and pull up when programming	(PROG9)
8	P87/XCIN	DC_SW	O	Control transmit transient. H: disable transmit PA; L: enable transmit PA.	
9	P86/XCOUT	shift	O	Frequency shift	
10	RESET	RESET	I	Reset when low level input.	(PROG8)
11	XOUT	XOUT	O	Crystal oscillator output pin. Connect to crystal oscillator.	
12	VSS	GND	I	GND	(PROG7)
13	XIN	XIN	I	Crystal oscillator input pin. Connect to crystal oscillator.	
14	VCC	VCC	I	VCC	(PROG1)
15	P85/NMI	NMI	NC	Connect to VCC through 47K resistor.	
16	P84/INT2	AF_TCLK	I	AK2346MSK serial clock (TCLK)	
17	P83/INT1	AUX1	O	Programmable port used for future development.	Used for future development.
18	P82/INT0	AF_RDF	I	AK2346MSK Rx detect (RDF/FD)	
19	P81	DTMF_SD	I	DTMF decode data input.	
20	P80	AUX5	I/O	Programmable port used for future development.	Used for future development.
21	P77	NC			
22	P76/TA3O	CTC_OUT	O	(PWM) output CTCSS/CDCSS to	

				VCO for modulation.	
23	P75	GPS_In	I	GPS input	
24	P74/TA2O	CTC_PLL	O	(PWM) output CTCSS/CDCSS to PLL for modulation.	
25	P73	AUX2	I/O	Programmable port used for future development.	Used for future development.
26	P72/TA1O	NC			
27	P71/RxD2/TB5IN	Accessory Port (patrol record)			
28	P70/TxD2	Accessory Port (patrol record)			
29	P67/TxD1	TXD1	O	Serial data output (communicate with computer)	(PROG10)
30	P66/RxD1	RXD1	I	Serial data input (communicate with computer)	(PROG4)
31	P65	NC		For programming only. Ground through 47K resistor.	(PROG3)
32	P64	NC		For programming only; monitor output.	(PROG2)
33	P63/TxD0	TXD0	I	Connect with option board	Used for future development.
34	P62/RxD0	RXD0	O	Connect with option board	Used for future development.
35	P61	EEP_SI	O	AT25 EEPROM data input	I/O AT24 EEPROM DATA input/output
36	P60	EEP_CLK	O	AT25/AT24 EEPROM clock pin	
37	P57/RDY	EEP_ID	1	1: 1M EEPROM; 0:512K EEPROM	
38	P56/ALE	NC			
39	P55/HOLD	NC		For programming only. Ground through 47K resistor.	(PROG) 6
40	P54/HLDA	AF_DIR	O	AK2346 DIR. Control the I/O of data transmission. H: output control word; L: read data.	
41	P53/BLCK	AF_SCK	O	AK2346 SCLK	
42	P52/RD	NC	O		
43	P51/BHE	AF_TDATA	O	AK2346 TDATA. MSK data output pin.	
44	P50/WR	NC		For programming only. Connect to VCC through 47K resistor.	(PROG) 5

45	P47/CS3	AF_DIO	I/O	AK2346 DATA I/O(SDAT). Output control word or read data.，	
46	P46/CS2	SBC	O	Control power supply. H: supply power; L: soft power down.	
47	P45/CS1	SAVE	O	Battery save control. H: valid; L: battery save.	
48	P44/CS0	R5C	O	R5C Control power of receiver. L: off; H: valid.	
49	P43/A19	T5C	O	T5C Control power of transmitter. L: off; H: valid.	
50	P42/A18	LED_EN	O	Control backlight. ;L: off; H: valid.	
51	P41/A17	C5	I/O	Key 5	
52	P40/A16	C6	I/O	Key 6	
53	P37/A15	C1	I/O	Key 1	
54	P36/A14	C2	I/O	Key 2	
55	P35/A13	C3	I/O	Key 3	
56	P34/A12	C4	I/O	Key 4	
57	P33/A11	PWS	I	Power on/off detect. H: soft power down; L: on.	
58	P32/A10	DTMF_ACK	O	DTMF decode data read clock.	
59	P31/A9	OPT_SEL	I	Accessory connection detect. H: no; L: yes.	
60	Vcc	VCC	I	VCC	
61	P30/A8	W_CON	O	Wide band control. H: wide band path open; L: wide band path closed.	
62	Vss	GND	I	GND	
63	P27/A7	PA_MUTE	O	Control audio power amplifier. H: on; L: off.	
64	P26/A6	N_CON	O	Narrow band control. H: narrow band path open; L: narrow band path closed.	
65	P25/A5	LEDR	O	Red light control. H: on; L: off.	
66	P24/A4	LEDG	O	Green light control. H: on; L: off.	
67	P23/A3	EN4	I	EN4 Channel Selector knob 4	Original: EN2
68	P22/A2	EN3	I	EN3 Channel Selector knob 3	Original: EN4
69	P21/A1	EN2	I	EN2 Channel Selector knob 2	Original: EN3
70	P20/A0	EN1	I	EN1 Channel Selector knob 1	Original: EN1

71	P17/INT5	PUMP_SW	O	Control PLL pump current to improve phase lock speed. H: high current; L: low current.	
72	P16/INT4	DTMF_EST	I	Rise edge is generated when the decode chip detects DTMF data.	
73	P15/INT3	MANDOWN	I	Man down detect.	
74	P14	AF_MUTE	O	Audio path switch. H: on; L: off.	
75	P13	MOTO_CON		Motor control. H: valid; L: stop.	
76	P12	PLL_UL	I	PLL unlock detect. H: locked; L: unlocked.	
77	P11	PLL_STB	O	PLL chip select output. H: select; L: off.	
78	P10	MIC_MUTE	O	MIC switch. H: off; L: on.	
79	P07/D7	PTT_EXT	I	External PTT input	
80	P06/D6	PLL_CLK	O	PLL clock output	
81	P05/D5	PLL_DATA	O	PLL data output	
82	P04/D4	T/R	O	Tx/Rx control. H: Rx; L: Tx.	
83	P03/D3	APC_SW	O	Control transient. H: APC circuit works; L: APC circuit is disabled.	
84	P02/D2	PTT	I	PTT detect. H: release; L: press.	
85	P01/D1	AK2346B_DIR	I/O	AK2346B register	B indicates the second AK2346 (using the same clock with the first AK2346) (for 5-Tone model)
86	P00/D0	AK2346B_DATA	O	AK2346B data	B indicates the second AK2346 (using the same clock with the first AK2346) (for 5-Tone model)
87	P107/AN7	NC			Reserved for patrol module. Not used.
88	P106/AN6	OPTION1	I	Determine option board according to different levels. Used for future development.	

89	P105/AN5	VOX	I	MIC signal input	
90	P104/AN4	BATT	I	BATT Battery level detect.	
91	P103/AN3	BATTSEL	I	Battery identification. Identify battery chemistry.	
92	P102/AN2	RSSI	I	RSSI detect pin.	
93	P101/AN1	SQL	I	Squelch level input.	
94	AVSS	GND	I	A/D conversion power grounded input.	
95	P100/AN0	CTC_IN	I	CTCSS signal input.	
96	VREF	VCC	I	A/D conversion reference voltage.	
97	AVCC	VCC	I	A/D conversion power input.	
98	P97	NC			Reserved for patrol module. Not used.
99	P96	LCM_RST	O	LCM reset/TP1	
100	P95	LCM_CD	O	LCM_data/command identification. H: data; L: command.	

TC-780 VHF Parts List 1 (Main Board Unit)

TC-780 UHF Parts List 1 (Main Board Unit)

TC-780 VHF/UHF Parts List 1 (Keyboard Unit)

Adjustment Description

Required Test Instruments

1. Radio communication test set 1 set
2. Scanner 1 set
3. 3A/10V power supply 1 set
4. Digital voltmeter 1 set
5. 3A ammeter 1 set

Preparation

1. All Reset

1) Enter the Mode

Turn on the radio while holding down and SK1, and then release the keys to enter all reset mode.

2) Select Frequency Band

Press ▲/▼ to select the corresponding frequency band, and then press OK.

3) Select Reset Type:

"Reset function"

"Reset radioINFO"

"Reset all data"

Press ▲/▼ to select a reset type. Press C to return to the previous menu, or OK to confirm and enter the lower level menu. When confirming initiation data, the LCD displays as follows according to the three reset types:

"Confirm ?"	"Confirm ?"	"Confirm ?"
"Reset function"	"Reset radioINFO"	"Reset all data"

Press C to return to the previous menu, or OK to confirm and enter data initiation process. The radio displays:

"Wirting data..."

"Please Wait"

4) After reset is completed, the radio displays "Successful".

2. VCO

Item	Condition	Measurement		Adjustment		Specifications/ Remarks
		Test Instrument	Terminal	Part	Method	
1. Setting	1. Power supply					
2. Tx VCO Lock Voltage	1. CH: Tx high.	Digital Voltmeter VCO Adjusting Fixture	CV	TC114	3.6V±0.1V	
	2. CH: Tx low.				Check	>0.5V
3. Rx VCO Lock Voltage	1. CH: Rx high.				4.0V±0.1V	
	2. CH: Rx low.			TC104	Check	>0.5V

Adjustment Procedures

1. Procedures before Adjustment

Turn on the radio while holding down SK2 and −, and then release the keys to enter manual adjust mode.

2. Adjustment Items

The purpose of manual adjustment is to adjust Tx frequency deviation, transmit power, Rx sensitivity, squelch, and etc.

1) SK2 Key

Set the operating frequency. Center frequency F3 is for one-point adjustment; F1, F3 and F5 are for three-point adjustment, and F1 through F5 are for five-point adjustment. Frequency switches from low to high in cycle.

2) OK Key

Set channel bandwidth. Value switches in the cycle of 25K -> 20K -> 12.5K. The red LED glows once when 25K is selected.

3) PTT/SK1 (or the Channel Selector knob)

Press the PTT to adjust up, and press SK1 to adjust down. You may also rotate the Channel Selector knob clockwise to adjust up, or counter-clockwise to adjust down. Press the PTT to select a value for items BATT LOW, SQL and VOX.

4) Select an Adjustment Item

After entering the adjustment mode, the radio enters the first adjustment item. Press ▲/▼ to select an adjustment item and save the adjustment value of the previous item. When adjusting Tx items, LED glows red; when adjusting Rx items, LED glows green

5) Save an Adjustment Value

After adjustment is completed, you need to press ▲/▼ to save the adjustment value and go to another adjustment item.

6) Adjustment of Tuning Frequency Points (Tuning frequencies are set through the programming software.)

- Five-point Adjustment (MHz)

  TX: {TX1, TX2, TX3, TX4, TX5};

  RX: {RX1, RX2, RX3, RX4, RX5}.

- Three-point Adjustment (MHz)

  TX: {TX1, TX3, TX5};

  RX: {RX1, RX3, RX5}.

- One-point Adjustment (MHz)

  TX: {TX3};

RX: {RX3}.

7) Frequency Table of Five-point Adjustment

Frequency Band (MHz)	Point 1 (MHz)	Point 2 (MHz)	Point 3 (MHz)	Point 4 (MHz)	Point 5 (MHz)
136-174(V)	TX1:136 RX1:136.15	TX2:145.5 RX2:145.65	TX3:155 RX3:155.15	TX4:164.5 RX4:164.65	TX5:174 RX5:173.85
400-470(U1)	TX1:400 RX1:400.15	TX2:417 RX2:417.15	TX3:435 RX3:435.15	TX4:452 RX4:452.15	TX5:470 RX5:469.85
450-520(U2)	TX1:450 RX1:450.15	TX2:467.5 RX2:467.65	TX3:485 RX3:485.15	TX4:502.5 RX4:502.65	TX5:520 RX5:519.85

8) After all reset is completed, channel data corresponding to each frequency band in user mode is shown in the following table:

Channel	Rx Frequency (MHz)	Tx Frequency (MHz)	Signalling	Power	Channel Spacing
1	RX1	TX1	None	High	25KHZ
2	RX3	TX3	None	High	25KHZ
3	RX5	TX5	None	High	25KHZ
4	RX1	RX1	None	Low	20KHZ
5	RX3	RX3	None	Low	20KHZ
6	RX5	RX5	None	Low	20KHZ
7	RX1	RX1	None	Low	12.5KHZ
8	RX3	RX3	None	Low	12.5KHZ
9	RX5	RX5	None	Low	12.5KHZ
10	RX3	RX3	67HZ	Low	25KHZ
11	RX3	RX3	254.1HZ	Low	25KHZ
12	RX3	RX3	023	Low	25KHZ
13	RX3	RX3	754	Low	25KHZ
14	RX3	RX3	2-TONE	Low	25KHZ
15	RX3	RX3	5-TONE	Low	25KHZ
16	RX3	RX3	None	Low	25KHZ

3. Operations and Objectives

Transmitter

Item	Condition	Test Instrument	Method	Objective

Power in tuning mode (Power In tune)	Enter the adjustment mode and select an item. The radio transmits. Adjust point 5 of wide band.	Radio Communication Test Set TX TEST	PTT (up) SK1 (down) or the Channel Selector knob (1-255)	Adjust power to 300±200mW
Tx Low Power (Tx L Power)	Enter the adjustment mode and select an item. Adjust point 5 of wide band.		PTT (up) SK1 (down) or the Channel Selector knob (1-255)	Adjust power to 1W±0.2W
CDCSS Balance (DCS Pll)	Enter the adjustment mode and select an item. Adjust point 3 of wide band, point 1 of medium band and point 3 of narrow band.	Radio Communication Test Set TX TEST HPF: 20Hz LPF: 3kHz	(1-255)	Make the demodulate waveform on the radio communication test set to square waveform.
CDCSS Deviation (DCS Dev)	Enter the adjustment mode and select an item. Adjust point 3 of wide band, point 1 of medium band and point 3 of narrow band.		PTT (up) SK1 (down) or the Channel Selector knob (1-255)	Adjust frequency deviation to 750Hz, 600Hz, 400Hz for wide, medium and narrow bands respectively.
CTCSS (67.0Hz) Low Frequency Deviation (CTCSS L Dev)	Enter the adjustment mode and select an item. Adjust point 3 of wide band, point 1 of medium band and point 3 of narrow band.		PTT (up) SK1 (down) or the Channel Selector knob (1-255)	Adjust frequency deviation to 750Hz, 600Hz, 400Hz for wide, medium and narrow bands respectively.
CTCSS (136.5Hz) Medium Frequency Deviation (CTCSS M Dev)	Enter the adjustment mode and select an item. Adjust point 3 of wide band, point 1 of medium band and point 3 of narrow band.		PTT (up) SK1 (down) or the Channel Selector knob (1-255)	Adjust frequency deviation to 750HzHz, 600HzHz, 400Hz for wide, medium and narrow bands respectively.

CTCSS (254.1Hz) High Frequency Deviation (CTCSS H Dev)	Enter the adjustment mode and select an item. Adjust point 3 of wide band, point 1 of medium band and point 3 of narrow band.		PTT (up) SK1 (down) or the Channel Selector knob (1-255)	Adjust frequency deviation to 750Hz, 600Hz, 400Hz for wide, medium and narrow bands respectively.
Tx Max Audio Deviation (Tx Max Dev)	Enter the adjustment mode and select an item. Adjust point 3 of wide band, point 1 of medium band and point 3 of narrow band.	Radio Communication Test Set Audio Test Cable TX TEST HPF: 20Hz LPF: 15KHz Audio Signal: 1KHz 120mV	PTT (up) SK1 (down) or the Channel Selector knob (1-63)	Adjust frequency deviation to 4±0.2KHz, 3.2±0.2KHz, 2.0±0.2KHz for wide, medium and narrow bands respectively.
2-Tone Deviation (Tone2 Dev)	Enter the adjustment mode and select an item. The radio transmits (disable MSK, MIC, DTMF, CTCSS/CDCSS). Adjust point 3 of wide band, point 1 of medium band, and point 3 of narrowband.	Radio Communication Test Set TX TEST HPF: 20Hz LPF: 15KHz	PTT (up) SK1 (down) or the Channel Selector knob (1-255)	Adjust frequency deviation to 3.2±0.2KHz, 2.5±0.2KHz, 1.8±0.2KHz for wide, medium and narrow bands respectively.
DTMF Deviation (DTMF Dev)	Enter the adjustment mode and select an item. The radio transmits (disable MSK, MIC, 2-Tone, CTCSS/CDCSS). Adjust point 3 of wide band, point 1 of medium band, and point 3 of narrowband.		PTT (up) SK1 (down) or the Channel Selector knob (1-255)	Adjust frequency deviation to 3.2±0.2KHz, 2.5±0.2KHz, 1.8±0.2KHz for wide, medium and narrow bands respectively.
MSK Deviation (MSK Dev)	Enter the adjustment mode and select an item. The radio transmits (disable DTMF, MIC, 2-Tone, CTCSS/CDCSS). Adjust point 3 of wide band, point 1 of medium band, and point 3 of narrowband.		PTT (up) SK1 (down) or the Channel Selector knob (1-63)	Adjust frequency deviation to 2.5±0.2KHz, 2.0±0.2KHz, 1.6±0.2KHz for wide, medium and narrow bands respectively.

VOX GAIN1 (bVox Gain Min)	Enter the adjustment mode and select an item. Adjust point 1 of wide band.	Radio Communication Test Set TX TEST HPF: 20Hz LPF: 15KHz	Save	Adjust the frequency to 1KHz, and amplitude to 10mv for modulation signal, and then press the PTT to save.
VOX GAIN10 (bVox Gain Max)	Enter the adjustment mode and select an item. Adjust point 1 of wide band.		Save	Adjust the frequency to 1KHz, and amplitude to 6mv for modulation signal, and then press the PTT to save.
Tx High Power (Tx H Power)	Enter the adjustment mode and select an item. Adjust point 5 of wide band.	Radio Communication Test Set TX TEST	PTT (up) SK1 (down) or the Channel Selector knob (1-255)	Adjust power to 5W, (4.7W) ±0.2W. Note: VHF: 5W UHF: 4.7W
Tx Medium Power (Tx M Power)	Enter the adjustment mode and select an item. Adjust point 5 of wide band.	Radio Communication Test Set TX TEST	PTT (up) SK1 (down) or the Channel Selector knob (1-255)	Adjust power to 2±0.2W
Tx Low Battery	Enter the adjustment mode and select an item. Adjust point 1 of wide band (transmitting at high power).	Power Supply	Save	Adjust the voltage to 5.8V and then press the PTT key to save.

Receiver

Item	Condition	Test Instrument	Method	Objective

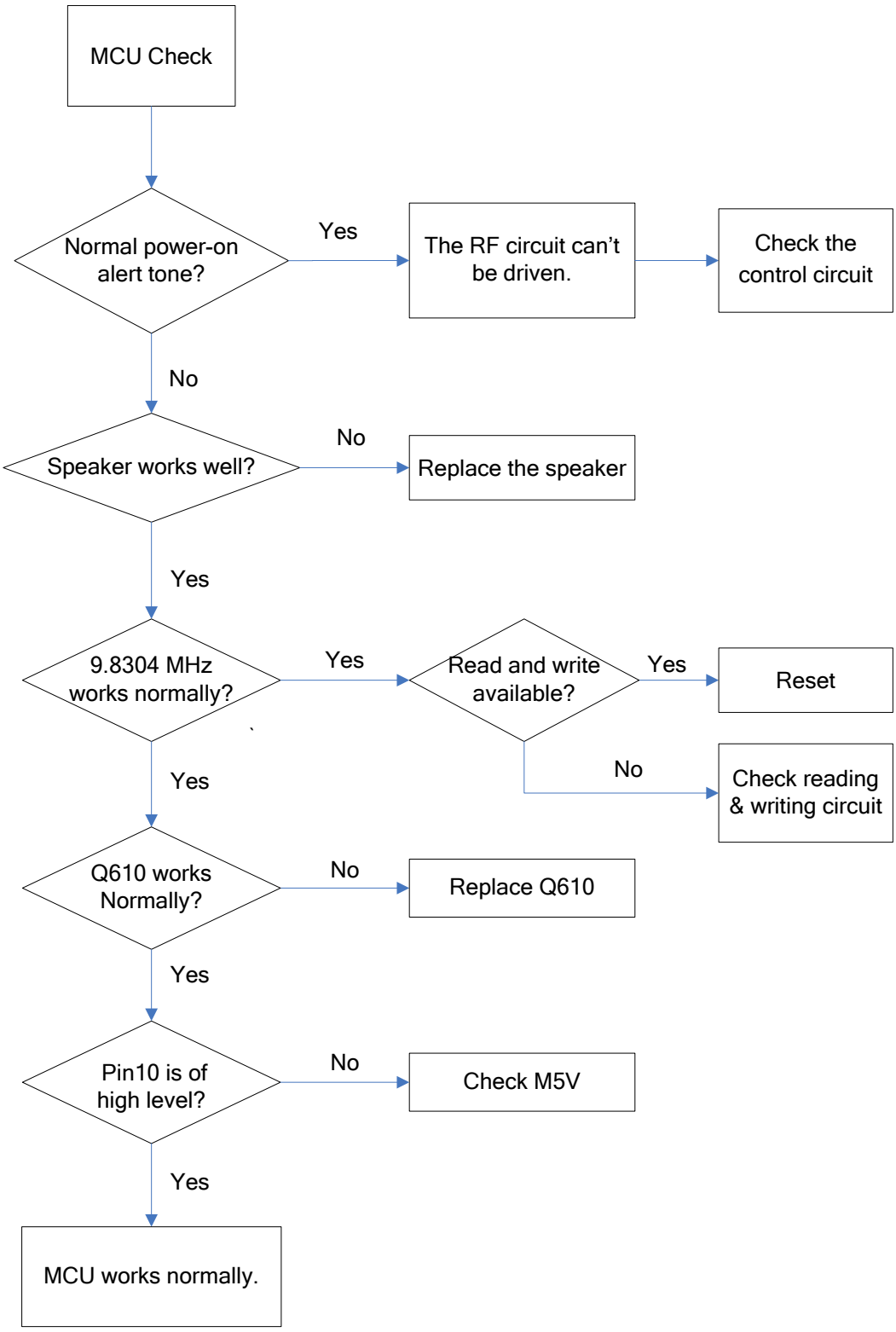
Bandpass Waveform	Enter the adjustment mode and select the Rx Sensitivity item. Adjust point 5 of wide band.	Scanner Bandpass Test Fixture	PTT (up) SK1 (down) or the Channel Selector knob (1-255)	Adjust the bandpas waveform to: UHF: VHF:
Rx Sensitivity	Enter the adjustment mode and select an item. Adjust point 5 of wide band.	Radio Communication Test Cable Audio Test Cable RX TEST HPF: 300Hz LPF: 3KHz Audio Setting: Frequency: 1kHz Frequency Deviation: 3kHz	PTT (up) SK1 (down) or the Channel Selector knob (1-255)	When level adjusted to -119dBm, SINAD≥12Db
12dB Sensitivity RSSI (RSSI 12dB)	Enter the adjustment mode and select an item. Adjust point 1 of wide band and point 1 of narrow band.		Save	Adjust the RF level of the radio communication test set until the audio SINAD gets to12dB. Press PTT to save the current RSSI value.
AK2346 Rx Volume Adjust (Rx Max Volume)	Enter the adjustment mode and select an item. Adjust point 1 of wide band.	Radio Communication Test Cable Audio Test Cable RX TEST HPF: 300Hz LPF: 3KHz Load Resistance: 20ohms	PTT (up) SK1 (down) or the Channel Selector knob (0-8)	When the volume is adjusted to the maximum level, AC Level is adjusted to 1.8W±0.2W (20ohms). Single path inputs AC Level of 3.0V±0.2V, while dual paths input AC Level of 6V±0.2V.

SQL Value of Normal Squelch Open (SqlNorOpen)	Enter the adjustment mode and select an item. Adjust point 5 of wide band, point 1 of medium band, point 5 of narrow band.	Radio Communication Test Cable Audio Test Cable RX TEST HPF: 300Hz LPF: 3KHz	Save	Adjust the level to -120dBm and press PTT to save.
SQL Value of Normal Squelch Close (SqlNorSquelch)	Enter the adjustment mode and select an item. Adjust point 5 of wide band, point 1 of medium band, point 5 of narrow band.		Save	Adjust the level to -122dBm and press PTT to save.
SQL Value of Tight Squelch Open (SqlTigOpen)	Enter the adjustment mode and select an item. Adjust point 5 of wide band, point 1 of medium band, point 5 of narrow band.		Save	Adjust the level to -117dBm and press PTT to save.
SQL Value of Tight Squelch Close (SqlTigSquelch)	Enter the adjustment mode and select an item. Adjust point 5 of wide band, point 1 of medium band, point 5 of narrow band.		Save	Adjust the level to -119dBm and press PTT to save.
Rx Low Battery	Enter the adjustment mode and select an item. Adjust point 1 of wide band.		Save	Adjust the voltage of power supply to 7.2V and press PTT to save.

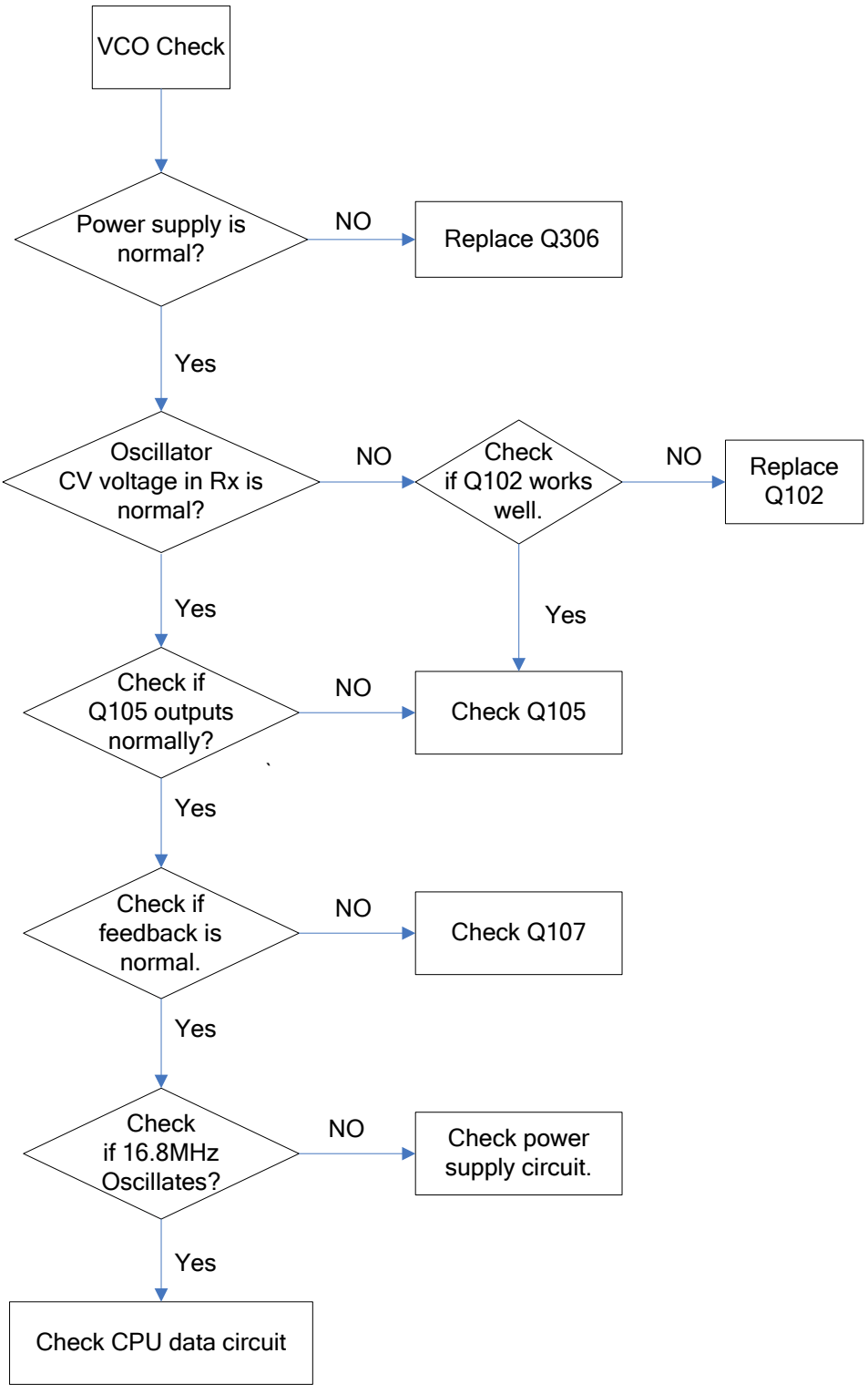
Note: Frequency deviation of receiver: 3 KHz for wide band, 2.5 KHz for medium band, and 1.5 KHz for narrow band.

Troubleshooting Flow Chart

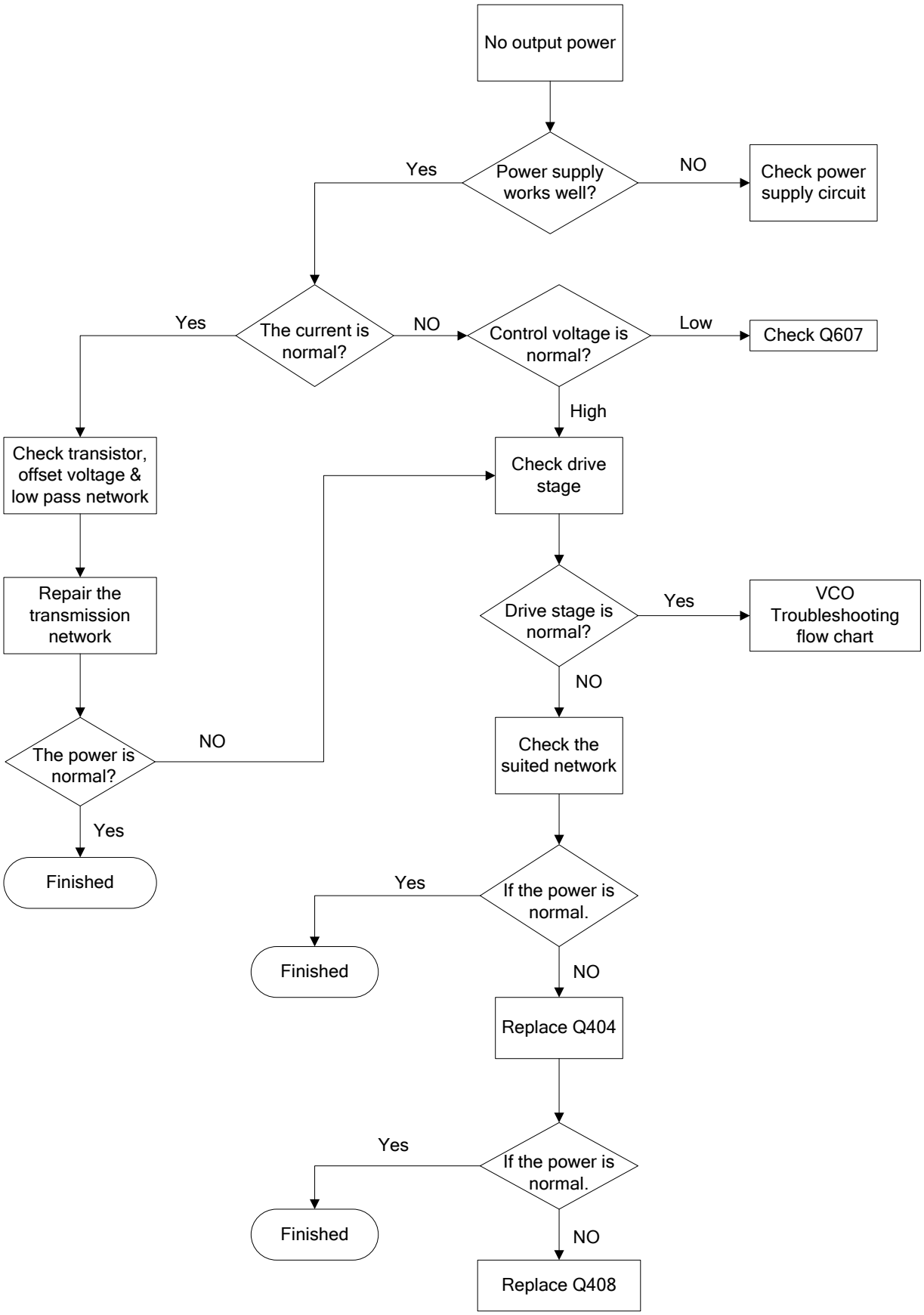
MCU


MCU Check
Normal power-on alert tone?
Yes
The RF circuit can't be driven.
Check the control circuit
No
Speaker works well?
No
Replace the speaker
Yes
9.8304 MHz works normally?
Yes
Read and write available?
Yes
Reset
No
Check reading & writing circuit
Yes
Q610 works Normally?
No
Replace Q610
Yes
Pin10 is of high level?
No
Check M5V
Yes
MCU works normally.

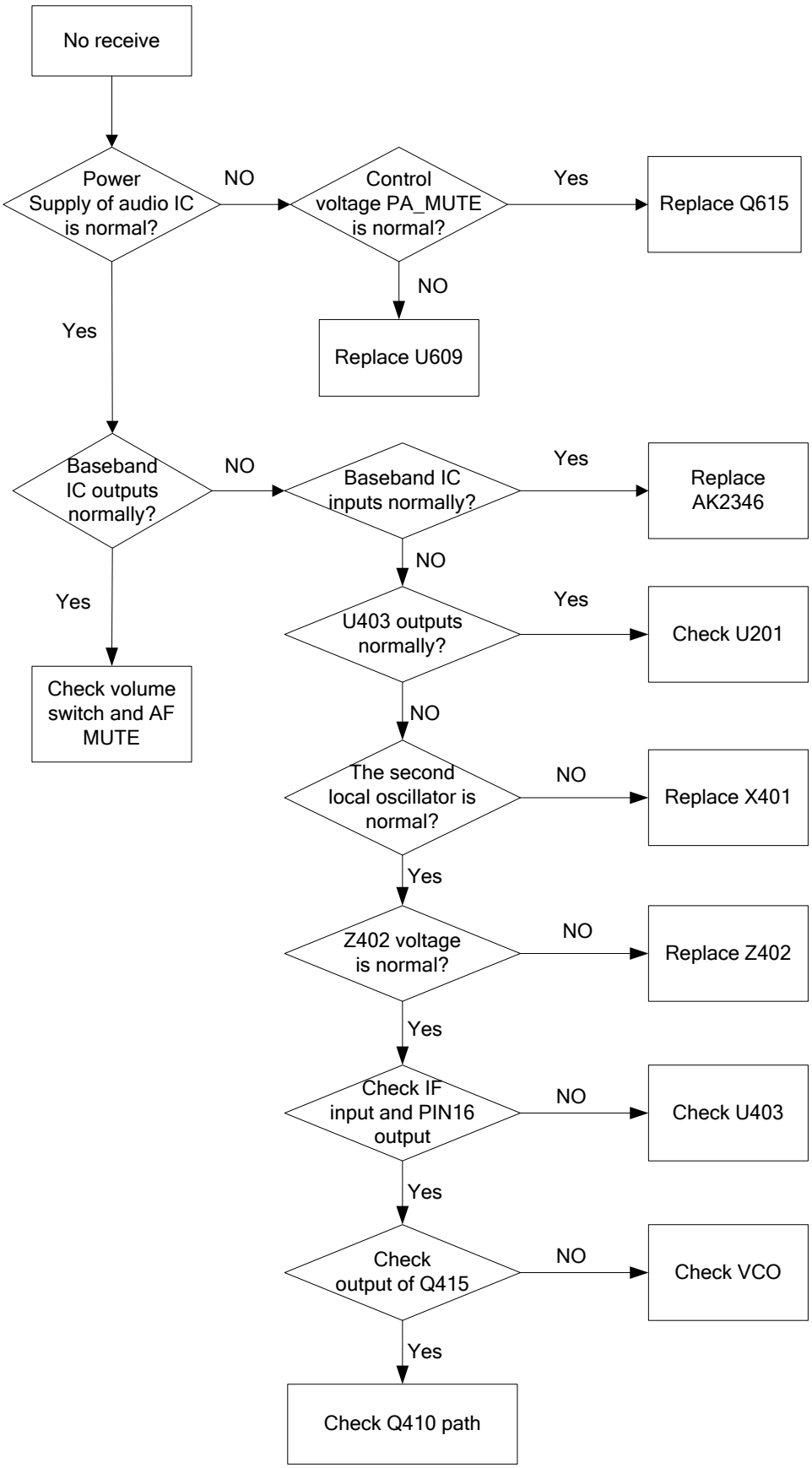
VCO



Transmit Circuit



Receive Circuit


No receive
Power Supply of audio IC is normal?
NO
Control voltage PA_MUTE is normal?
Yes
Replace Q615
NO
Replace U609
Yes
Baseband IC outputs normally?
NO
Baseband IC inputs normally?
Yes
Replace AK2346
NO
Yes
U403 outputs normally?
Yes
Check U201
Check volume switch and AF MUTE
NO
The second local oscillator is normal?
NO
Replace X401
Yes
Z402 voltage is normal?
NO
Replace Z402
Yes
Check IF input and PIN16 output
NO
Check U403
Yes
Check output of Q415
NO
Check VCO
Yes
Check Q410 path

Disassembly and Assembly for Repair

Disassemble the Radio Case

1. Remove the Radio On-Off/Volume Control knob ① and Channel Selector knob ②.
2. Lift the chassis by its bottom and pull it out of the radio case ③.

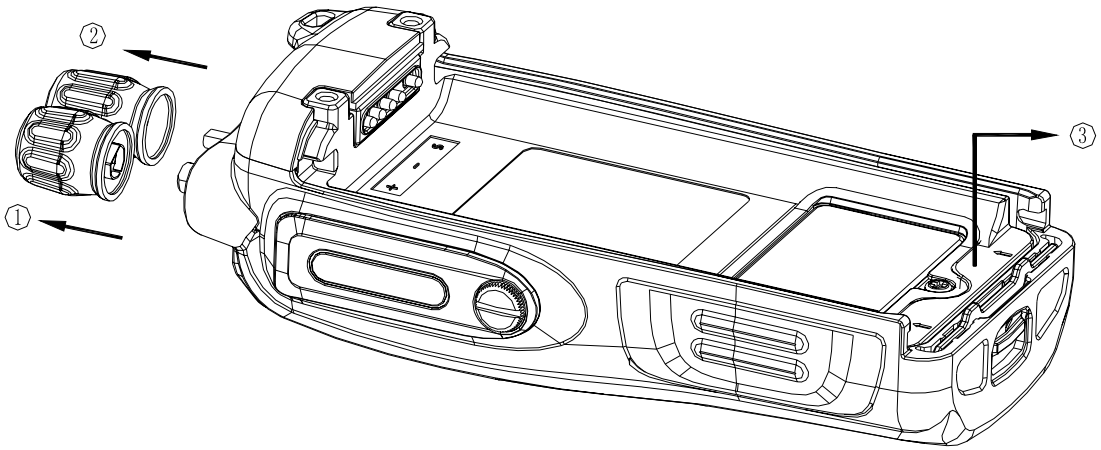


Figure 1

Disassemble the Speaker

1. After you separate the chassis from the case, turn it for a certain degree, then disassemble the FPC from the connector on the PCB. Then remove the screw ④ on the speaker fixing ring, and remove the speaker fixing sheet ⑤.
2. Remove the speaker ⑥ and microphone ⑦.

Note: Take care not to damage the FPC connecting the speaker and the chassis.

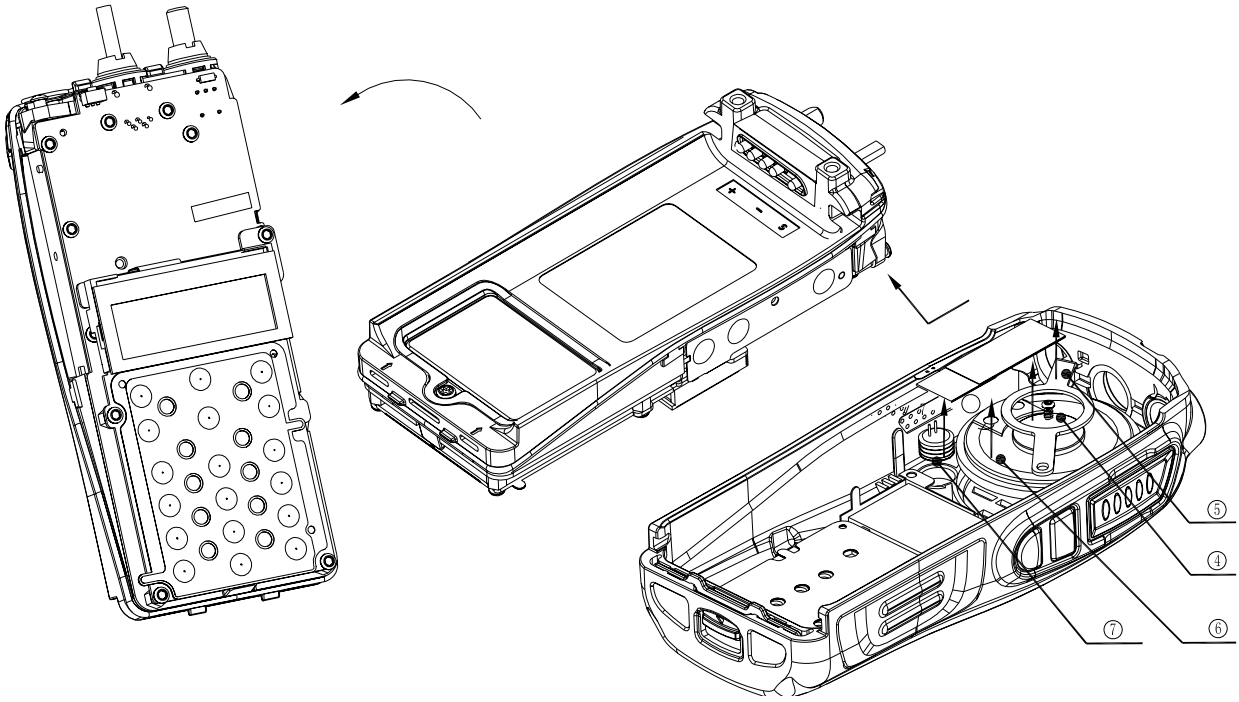


Figure 2

Disassemble the Transmit and Receive Units

1. Screw out the waterproof ring ⑧, the nut ⑨, and screws ⑩ locking the keypad PCB, shown in figure 3.

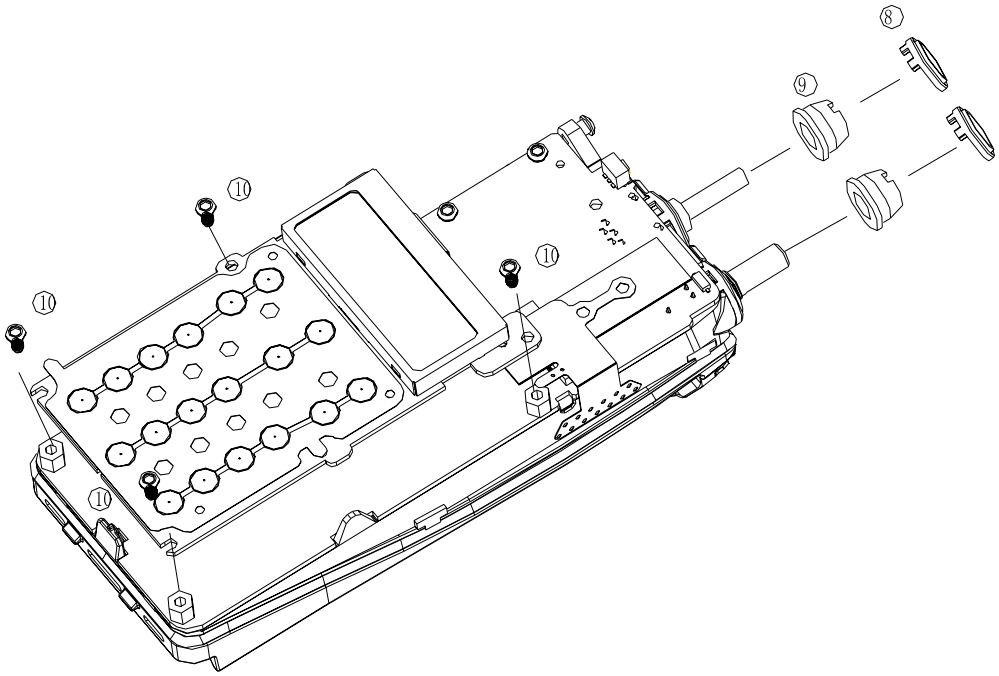


Figure 3

2. Rotate the keypad PCB module ⑪ for 180 degrees, and then remove FPC ⑫ and FFC ⑬ from the connector on the PCB.

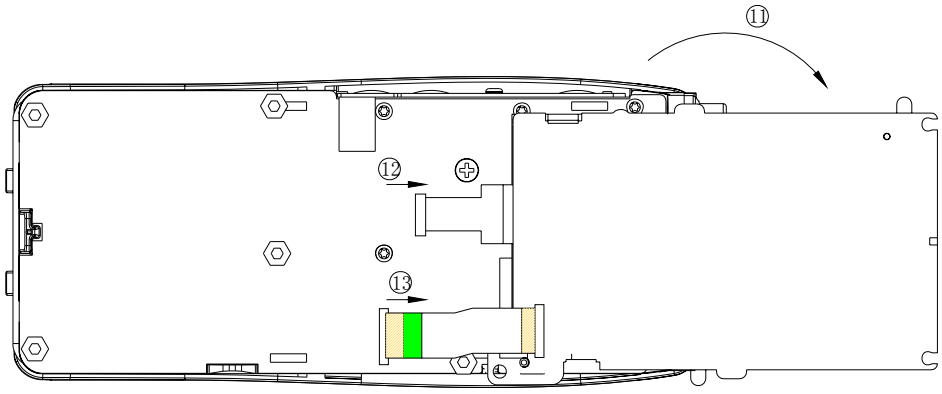


Figure 4

3. Remove the five DB head screws ⑭ on the PCB, screws ⑮ locking the PCB, and the screw ⑯ locking the side PTT keyboard.
4. Use an electric soldering iron to remove the two leads connecting motor from the PCB, and then to unsolder the soldering tin at the antenna connector.
5. Lift the PCB ⑰ and remove it from the chassis.

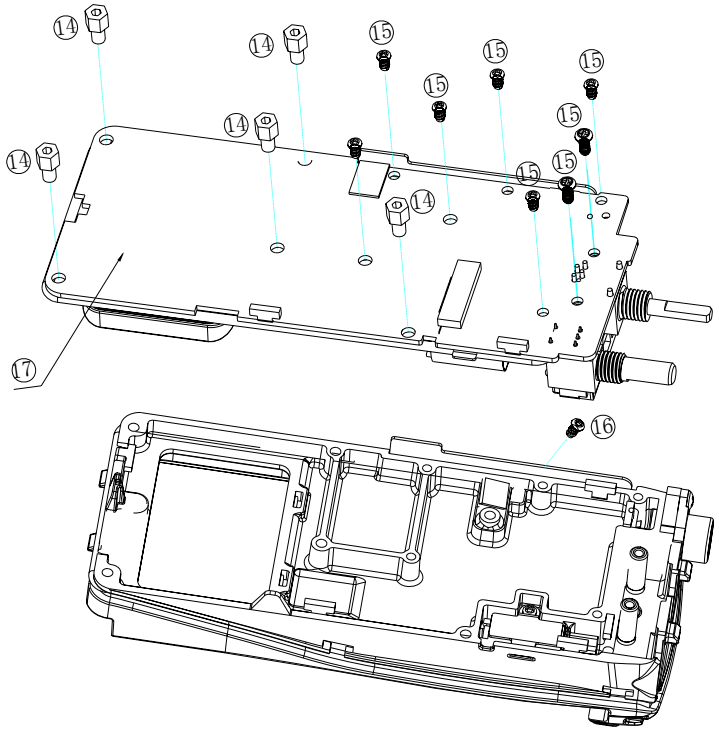


Figure 5

Precautions for Assembly

Assemble the Radio Case and Chassis

1. Make sure the waterproof cushion surrounding the chassis is well fitted into the slot ① of the chassis.
2. Correctly position and assemble the speaker on the radio case ②.

Note: Make sure that the speaker is fully assembled in the radio case.

3. Fix the speaker sheet to the speaker, and secure it with screw ③.
4. Insert the top of the chassis into the radio case ④.

Note: Never have the speake magnetic core being pressed the FPC.

5. Press the bottom of the chassis downwards to fit the chassis into the radio case.

Note: If the chassis is assembled into the radio cas while the waterproof ring is n in position, use your fingers t place it at the right position.

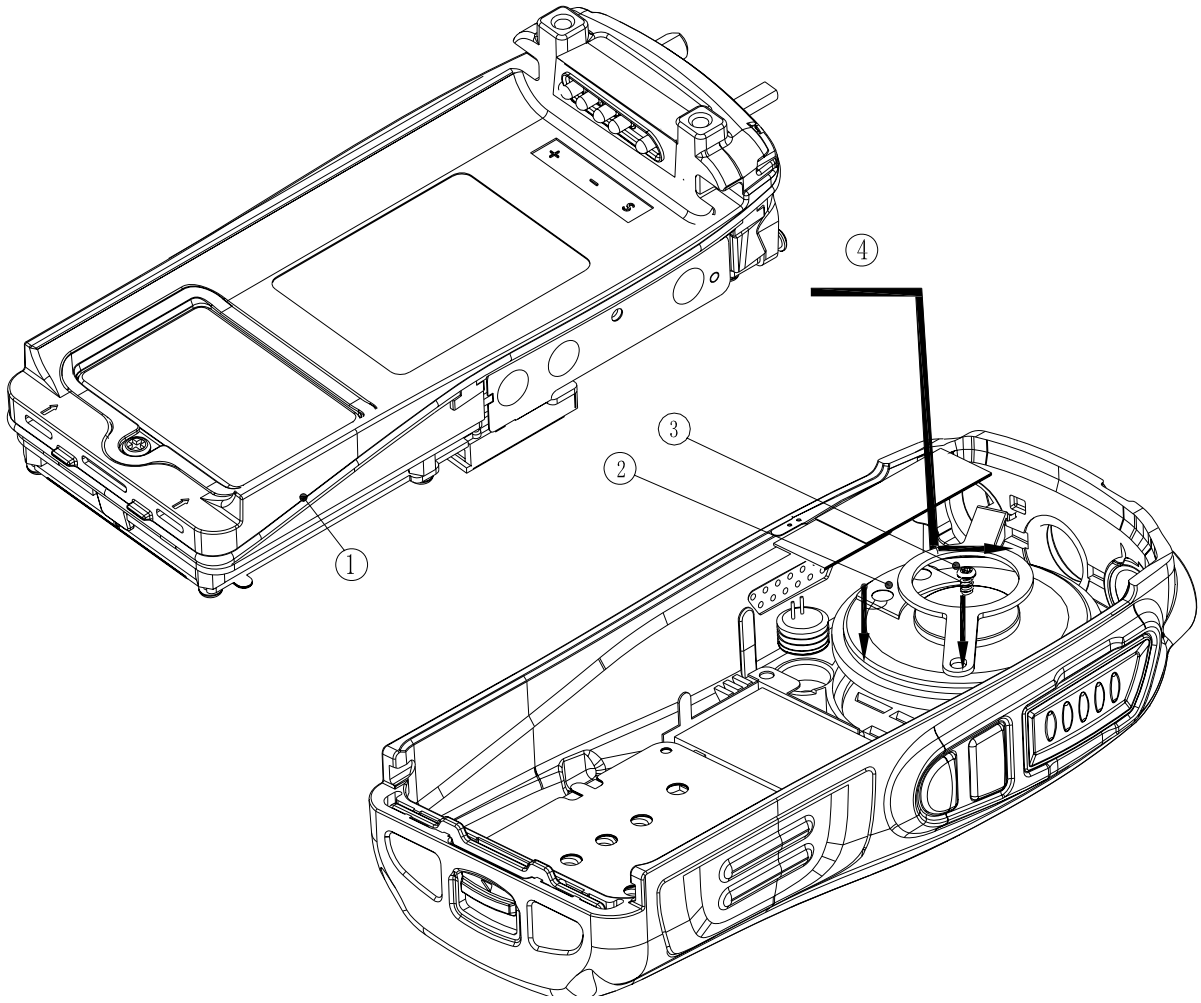
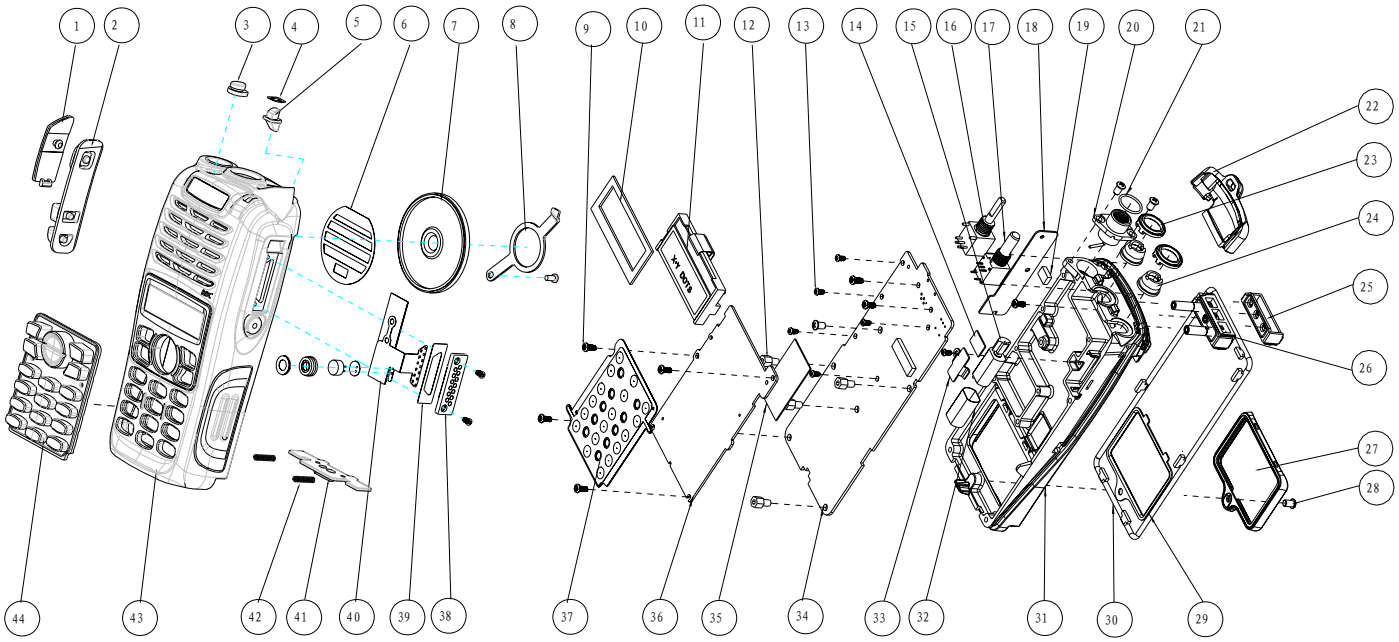


Figure 6

Exploded View

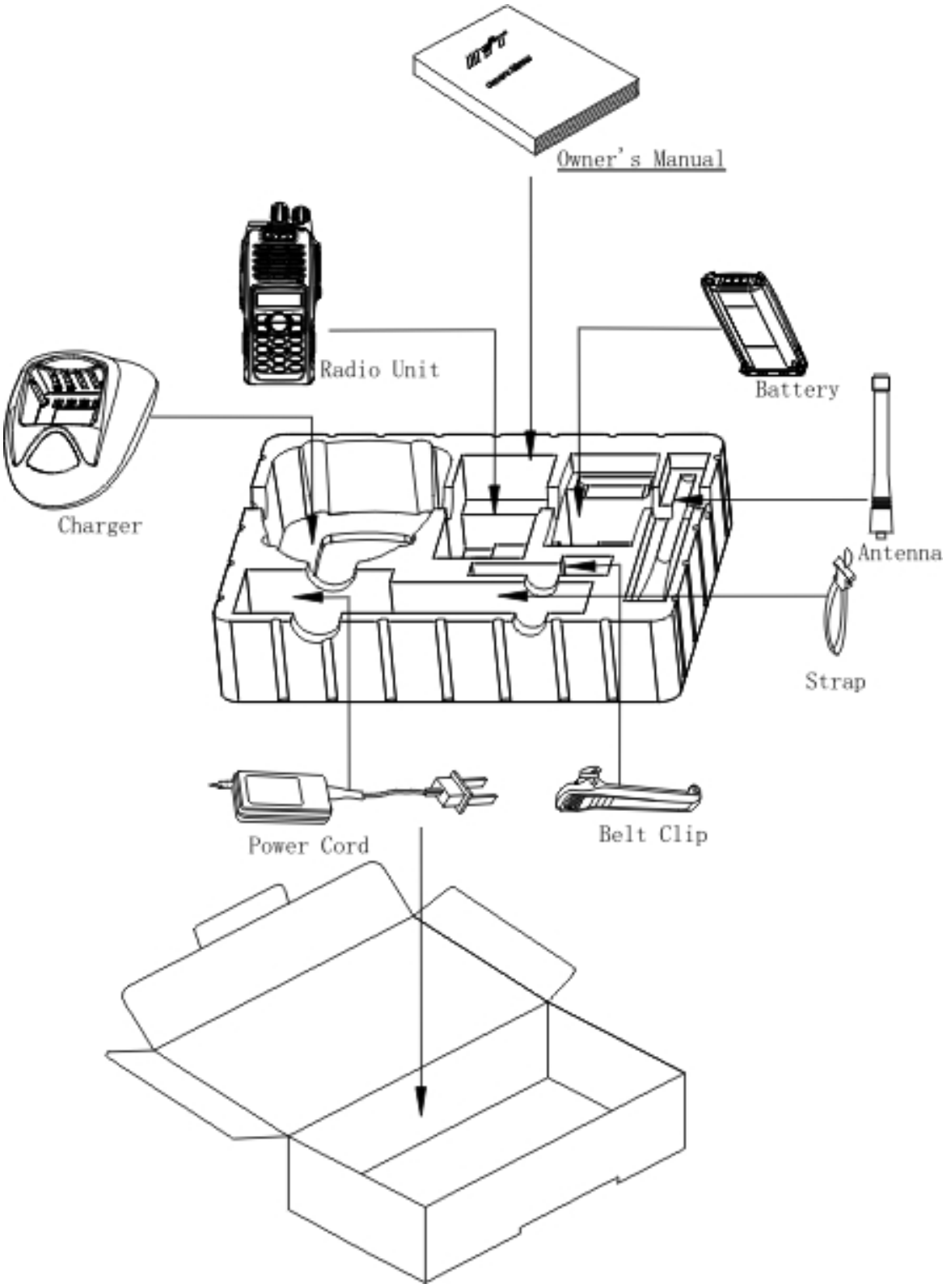


TC-780 Parts List 2

No.	Material No.	Description	Qty.
1	6000135000000	PTT key cover (RoHS)	1

2	6100068000000	PTT key (silica rubber) (RoHS)	1
3	6100319000000	Emergency key (silica rubber) (RoHS)	1
4	7500210000000	Adhesive tape, light guide 3M(9448) (RoHS)	1
5	6000609000000	Light guide (RoHS)	1
6	7400208000000	Felt, speaker PES+PBO(U500PBO) ∅40.0 (RoHS)	1
7	5001210000170	Speaker 20Ω 1W/3W 90dB Φ40mm H5.0mm (RoHS)	1
8	6201545000000	Fixing sheet, speaker (RoHS)	1
9	7102003500200	Machine screw M2.0*3.5mm (RoHS)	4
10	7500230000000	Upper sponge, LCD (RoHS)	1
11	5110000000410	LCD module (RoHS)	1
12	7102504000400	DB head screw (screw 2.5*4, nut 2.0*3) (RoHS)	5
13	7102004021030	Self-tapping screw ST1.9*4.0mm (RoHS)	12
14	4210015000000	FPC (4Pin) 0.8T*30mm (RoHS)	1
15	5402001000010	Vibrating motor (RoHS)	1
16	4305030000050	E rotary switch (RoHS)	1
17	4302020000040	Volume switch (RoHS)	1
18	4100710200100	Side PTT keyboard (RoHS)	1
19	7500114000000	Cooler pad (RoHS)	1
20	4400000000000	SMA connector, male, 50Ω (RoHS)	1
21	6100316000000	O_Ring (RoHS)	1
22	6000608000000	Rear cover PC(EXL9330) (RoHS)	1
23	6100069000000	Waterproof ring, volume control knob (RoHS)	2
24	7206004200000	Nut M6.0*4.2mm (RoHS)	2
25	6100322000000	Waterproof ring, battery connector (RoHS)	1
26	5202003100150	Battery connector (RoHS)	1
27	6100290000000	Waterproof ring, expansion port (RoHS)	1
28	7102504000300	Machine screw M2.5*4.0mm (RoHS)	1
29	6201507000000	Cover, expansion port (RoHS)	1
30	6100318000000	Waterproof ring (RoHS)	1
31	6300050000000	Aluminum chassis ADC12 (RoHS)	1
32	7500219000000	Motor (RoHS)	1
33	6201543000000	Sheet, motor (RoHS)	1
34	1300007100020	TC-780 PCB	1
35	4100710100100	FFC (14Pin) (RoHS)	1
36	1300007100030	Keyboard	1
37	7300028000000	Metal dome, function key (RoHS)	1
38	6000198000020	Earpiece jack (RoHS)	1
39	7400128010100	Waterproof PC pad (RoHS)	1
40	41007101002C0	FPCB (20Pin) (RoHS)	1
41	6000680000000	Battery latch (RoHS)	1
42	7000036000000	Spring (RoHS)	2
43	6000612000000	Front cover PC(EXL9330)+PMMA(CP-61) (RoHS)	1
44	6100317000000	Numeric keypad (RoHS)	1

Packing


Owner's Manual
Radio Unit
Battery
Charger
Antenna
Strap
Power Cord
Belt Clip

TC-780 VHF PCB View

TC-780 UHF PCB View

TC-780 VHF/UHF PCB View

TC-780 Block Diagram

TC-780 VHF Schematic Diagram

TC-780 UHF Schematic Diagram

TC-780 VHF/UHF Schematic Diagram

Specifications

General	
Frequency Range	VHF: 136-174MHz UHF: 350-390MHz 400-470MHz 450-520MHz
Channel Capacity	256
Channel Spacing	25/20/12.5KHz
Operating Voltage	7.4V
Battery	1700mAh (Li-Ion)
Battery Life (5-5-90 duty cycle)	About 14 hours
Operating Temperature	-25℃-+60℃
Dimensions (H×W×D) (with battery, without antenna)	124×54×35mm
Weight (with antenna & battery)	340g
Receiver	
Sensitivity	0.25μV(W)/0.28μV(N)
Selectivity	70(W)/60dB(N)
Intermodulation	65dB
Spurious Response Rejection	70dB
Rated Audio Power Output	1W
Rated Audio Distortion	<5%
Frequency Stability	±2.5 ppm
Transmitter	
RF Power Output	5W/1W
Spurious and Harmonics	-36dBm<1GHz -30dBm>1GHz
Modulation Limiting	5 KHz(W)/2.5 KHz(N)
FM Noise	45/40dB
Modulation Distortion	<3%
Frequency Stability	±2.5 ppm

All specifications are tested according to TIA/EIA-603, and subject to change without notice due to continuous development.

HYT endeavors to achieve the accuracy and completeness of this manual, but no warranty of accuracy or reliability is given. All the specifications and design are subject to change without prior notice due to continuous technology development. Changes which may occur after publication are highlighted by Revision History contained in Service Manual.

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